

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC3550/EO3911

MIDTERM EXAM II

11/01 Prof. Powers

- This exam is closed book and notes except that notes on four sides of 8-1/2 x 11 paper are allowed.
- There is a 50 minute time limit.
- There are three problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be *sure* to include units in your answers.
- Please circle or underline your answers.
- Do *NOT* do any work on this sheet (except for Fig. 3).
- Show *ALL* work.

1	
2	
3	
Total	

Name: _____

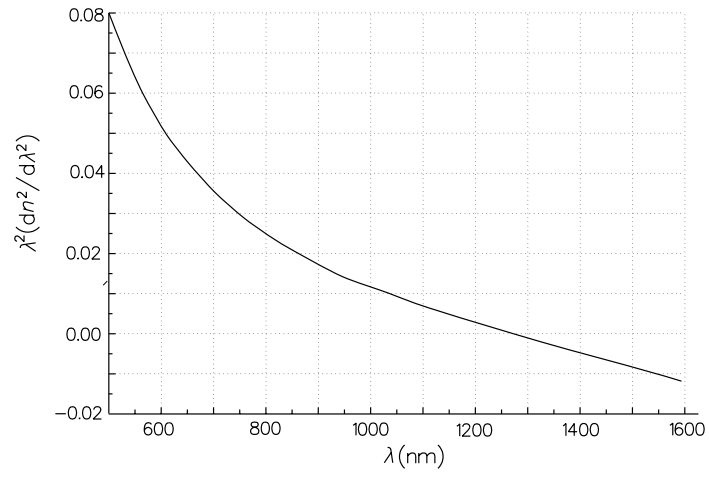


Figure 1: Fig. 3.8 of text

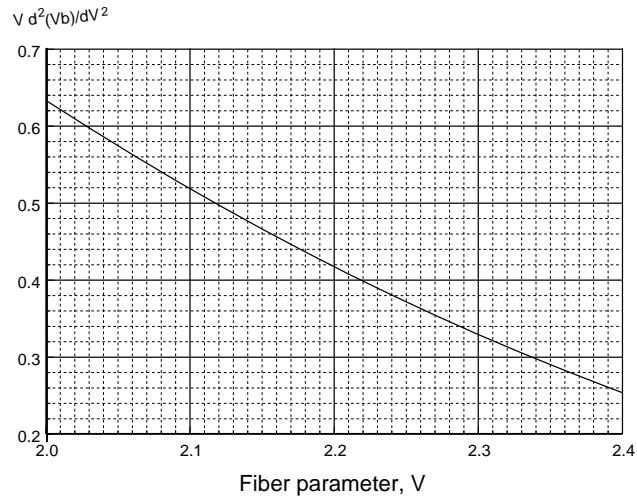


Figure 2: Fig. 3.10 of text

1. (a) What is the primary advantage of a graded-index multimode fiber over a step-index multimode fiber?
(b) List three applications of an AWG coupler.
(c) A 3x3 coupler has an insertion loss of 5.0 dB. What is the excess loss of the coupler?
(d) An officer-student asserts that “all diode lasers used in fiber systems have reliability problems”. What is your response?
-

2. We want to connect two singlemode fibers together. The fibers on each side of the connection are the same. They each have a mode-field diameter (MFD) of $8\text{ }\mu\text{m}$ and a core index of 1.460. The gap between the fiber ends is air.

Find the expected connector loss (in dB) at an operating wavelength of 1550 nm when the lateral displacement *and* the longitudinal separation are *each* equal to 10% of the MFD. The angular misalignment is zero.

3. Figure 3 (on the next page) shows the measured output characteristics of a 1550-nm VCSEL that were recently reported in the scientific literature.
 - (a) What are the measured threshold currents at 20C and 80C?
 - (b) The equation describing the dependence of the threshold current on temperature is $I_{Th}(T) = I_0 e^{T/T_0}$. Using the results of Part a, find T_0 . (Note: the conversion formula from Celsius to Kelvin is $T[\text{K}] = T[\text{C}] + 273$.)
 - (c) Using the results of Parts a and b, find I_0 .
 - (d) Using your results from Parts b and c, find the predicted threshold current at 70C.
-

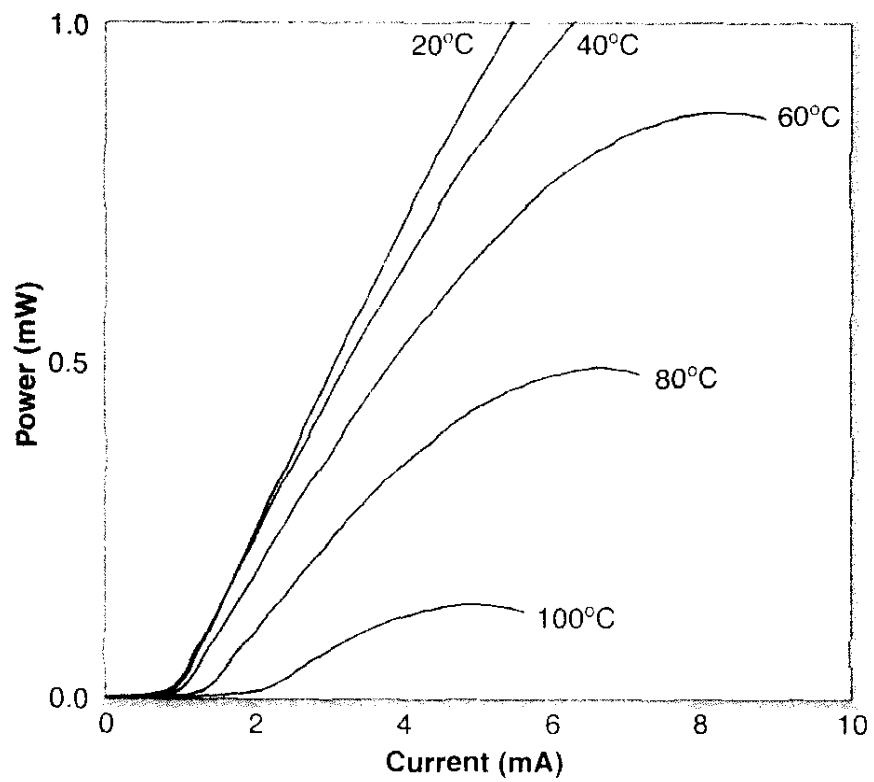


Figure 3: Figure for Problem 3. (From *Laser Focus World*, Dec. 2001.)